

Application No. 10/735,845
Amendment dated
Reply to Office Action of September 6, 2005

Docket No.: 20140-00314-US

REMARKS

Reconsideration of claims 1 and 3-11, and consideration of new claims 24-29 are respectively requested. Claim 3 is canceled. Claims 1, 5, 9 and 11 are amended.

The objection to claim 7 as including an improper Markush group is traversed. The Markush group is properly presented in the original claim.

The rejection of claim 11 under 35 USC 112, second paragraph is respectively traversed with respect to the amended claim.

The rejection of claims 1-4, 6, 7, 9 and 10 under 35 USC 102(e) as anticipated by Cooney (2004/0152295) is respectively traversed with respect to the amended claims. The term "interconnect copper line" is added to better define the claimed method of making an interconnect structure. No new matter is added.

The application as a whole describes a method of making an interconnect structure. See, Title and Field of Invention. As repeatedly referred to in the application, interconnect structures will contain one or more barrier layers "between the dielectric material and the conductive material in order to prevent atoms of the conductive material from diffusing into and at times through the dielectric material." The presence of the barrier layers minimize inter-level or intra-level shorts and junction leakage. Page 2, lines 4-10. In particular, copper atoms "exhibit relatively high diffusion mobility in most dielectric materials." Id., lines. 11-13. "As a result, if copper is used as an interconnect structure, the copper needs to be confined with a barrier layer." Id., lines 15-16.

The application further describes the process steps commonly used to provide a copper interconnect. See, Figs. 1A to 1C, which show a trench 14, via 15, copper line 12, and barrier layer 16. A copper plating process is then used to fill the trench thereby forming an interconnect copper line. Id., lines 17-29.

Cooney also describes an interconnect structure with conductive wires embedded in a dielectric material (see, para. 0004) having a barrier or liner structure (see, para. 0008). Cooney goes on to emphasize the "need in the industry for an improved liner structure, particularly for copper metallurgical structures," i.e., conductive wires. See, para. 0009. Cooney describes an

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improved liner structure having a front liner layer, which protects the via sidewalls from erosion during processing, and a second liner layer, which increases the contact area of the underlying metallization. See, para. 0010.

The rejection points to the "second liner layer 9 as the previously claimed conductive line. Claim 1 is amended to distinguish a conductive line from a copper interconnect line. See Fig. 3A and 3C and compare line structure 311 with barrier layer 317. One of ordinary skill in the art reading the entirety of the application and the cited reference would no doubt differentiate between a copper interconnect line and a barrier layer in a semiconductor interconnect structure. Claim 1, as amended, accounts for this distinction.

Accordingly, Applicants respectfully request that the rejection be withdrawn.

The rejection of claim 9 as anticipated by Cooney is respectively traversed. Claim 9 is rewritten in independent form as new claim 24. Referring to Figs. 1A and 1F, the rejection states that the "provided conductive line ("second liner layer" 9)...and the cap layer ("metal line" 2) are recessed in the dielective trench (5). Applicants respectfully disagree. As shown in Figs. 1A to 1F, cap layer (metal line 2) is not recessed in the dielective trench 5. Rather, the cap layer forms the bottom and sidewalls of the trench.

The term "recessed" means to place a material in a recess, i.e., an indentation or a cavity. As a result, the material that forms the recess cannot be placed in the recess. Accordingly, applicants respectfully request that the rejection be withdrawn, and that new claims 24-29 be allowed.

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Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 50-0510, under Order No. 20140-00314-US from which the undersigned is authorized to draw.

Dated: September 26, 2005

Respectfully submitted,

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